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Growing Christmas Trees in the South

U.S. DEPARTMENT OF AGRICULTURE • FOREST SERVICE
SOUTHEASTERN AREA, STATE & PRIVATE FORESTRY

General Report SA-GR 5

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GROWING CHRISTMAS TREES IN THE SOUTH

by

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and

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INTRODUCTION

Growing Christmas trees is an important industry in the South. Various estimates indicate that over 35 million Christmas trees are used in the United States each year. The long growing seasons and favorable climate of the South offers an excellent site for those engaged in this business. Moreover, most Southern States are net importers of Christmas trees. As a result, southern growers are in a favorable competitive position.

The production of quality Christmas trees requires intensive management. During certain times of the year growers must devote time to their plantations for cultural operations such as weed, grass and insect control, along with shaping of the trees. Time is also required for harvesting and marketing the final product. In short, prospective growers of Christmas trees must recognize that they will be investing an appreciable amount of time in this business enterprise, and that it is subject to certain competitive risks as are all ventures into the business community.

However, the financial returns from **well managed** plantations can be very rewarding and offers the small investor a high rate of return. In addition, many individuals derive a certain satisfaction from working on the land and building their own business during their spare time. In many cases, this is a family business with the rewards that come with tilling the soil and reaping the profits under proper management.

The purpose of this publication is to serve as a general guide and source of reference material to those already in the business and to those who are about to become a Christmas tree grower. The latter, especially, have many questions that need answers. How much investment is required? What species should I grow and how long before the trees are ready for harvest? How much time is required? How much money can I make? We hope the reader can find the answers to these and many other questions in this publication. More specific and detailed information on cultural practices is available from the addresses given in the comprehensive reference list.

Specific information for local use can be obtained from your State agricultural extension service, State forestry agency and your State or national Christmas tree growers association. Information on how to contact these sourses of help is included in this publication. We strongly urge you to contact those local sources of information before you initiate a Christmas tree operation.

PERSONAL REQUIREMENTS

The first and probably most important requirement of a successful Christmas tree enterprise is personal dedication and available time that can be devoted to the business. The grower who does not want to hire labor must have time available during the spring and summer for cultural operations and time in December for harvesting. In addition, if you depend only on your own labor or that of members of your family, establish a maximum size operation so that you do not extend yourself too far. Establish a portion of the plantation each year so that you gain experience as your operation expands. You can then correct any mistakes that occur during the early years without affecting the entire operation.

The experience you gain in the early stages will become extremely valuable in effectively handling a larger volume of business in future years. Many growers start by planting 1 acre per year so that by the time of first harvest, within 7 years, they will have up to 7 acres (2.8 ha) to manage. In this way, you can build gradually on your expertise and required equipment.

SITE SELECTION

Your choice of a site can decide the success or failure of a Christmas tree operation. Some major qualities of good and poor sites are discussed below.

Fertility.—Some species, such as the firs, are more demanding. They require more moisture and more fertile sites than most pines. Trees on sites that are too fertile may require more frequent pruning and shearing. Poor sites mean longer rotation (the time it takes a seedling to reach a marketable size and to replant cutover sites) and higher fertilizer costs or, in some cases, outright failures. Avoid deep, droughty sands and wet, poorly drained soils.

Topography.—Flat to gently rolling sites offer the best opportunity for economical production. Site preparation, planting, cultural treatments and harvesting are all easier, cheaper and less demanding of machinery and labor on these sites. If the land is too steep for you to operate your equipment efficiently, be sure that an adequate supply of labor will be available at the appropriate time. In the mountainous areas some species, such as Fraser fir and white pine, are more sensitive to elevation and the direction the slope faces (aspect).

Vegetation.—The most desirable sites are fields that have recently been in cultivation, as they are free of weeds, grasses and competition from other trees. They usually have some residual fertilizer from the previous agricultural use. Grassy fields will require more vegetative control to eliminate sod competition. Use a mower and herbicides (no till method) to eliminate the sod competition without disking or cultivating. Cutover tracts that were in trees require the most intensive and expensive treatment to put the land in shape for Christmas tree production.

Accessibility.—Nearby, all-weather roads are important, particularly in the mountains and in colder climates. Poor roads combined with bad weather at harvesting time can severely hamper or stop cutting operations. A relatively level area large enough to unload supplies and equipment, as well as load trees, is essential. Too accessible sites are more subject to theft and may need patrolling in December; however, even poor accessibility gives no assurance against theft.

This level, old field is ideal for cultural operations.

SPECIES SELECTION

Several factors will help you select a tree species: First, what species will do well in the area? As a starting point, contact a local service forester, county agent or check with nearby growers. Eliminate species that are not acclimated to your area and site.

Next, carefully review the consumer preference in the area to be served, to help select a species with a high market demand.

Then compare several species for the time each requires to reach a merchantable size. Also compare them for relative market values and for their cultural requirements.

Check with journals, commercial Christmas tree growers associations, nursery publications, State forestry agencies and extension services for the best sources of seedlings for the species selected. Remember, the seed source can be critical for both adaptablity to local climate and inherited characteristics.

PLANTING

SITE PREPARATION

Remove weeds, grass, and other plants before or at the time of planting. If uncontrolled, they will compete with your seedlings for light, nutrients, and water—and reduce the survival and early growth of your seedlings. The degree of site preparation will depend on the kind and amount of vegetation present. If a light cover of grass and weeds is present, you can burn or mow them, or spray them with an approved herbicide in a row or band next to the planting site. If a heavy sod is present, mow it, then apply a herbicide in a band. Deep scalping or furrowing leaves ridges in the soil that impede future operations. Remove small trees and shrubs by disking or intensive cultivation. Allow disked or cultivated land to settle before planting. Keep competing vegetation under control in newly established plantations to maintain tree growth and prevent shading of the lower branches. Mow grass and weeds or apply herbicides as often as needed to keep them under control. If the competing plants are not removed or controlled your seedlings will grow more slowly and their lower branches will be shaded out. This will result in poorly formed, lower quality trees, reducing their future value.

ESTABLISHING THE PLANTATION

Once you select the species and, in some cases, the seed source, your next steps are to:

1. Protect the seedling from the time they leave the nursery until they are planted.
2. Plant trees properly.
3. Recognize local conditions.

This landowner has insured proper spacing and alignment by marking rows before planting. Handplanting is necessary for accurate placement of seedlings.

TRANSPORTING, HANDLING AND STORING SEEDLINGS

Handle and Ship with Care

From the time a seedling is lifted from the nursery bed until it is safely planted in the field, the greatest cause of mortality is too much root exposure to sun, wind, or dry air.

Like other living things, baled seedlings generate heat. If you transport large quantities of seedlings or arrange for their transportation, the ideal solution is to use refrigerated trucks, but the cheaper alternative is slat-sided trucks with a tarpaulin top. For small numbers of seedlings, avoid long distances in completely open trucks as excessive drying will cause needle burn. In warm weather haul seedlings at night, if possible. Temperatures in the bales should not exceed 85° F. (29° C) for any length of time (122° F [50° C] is lethal).

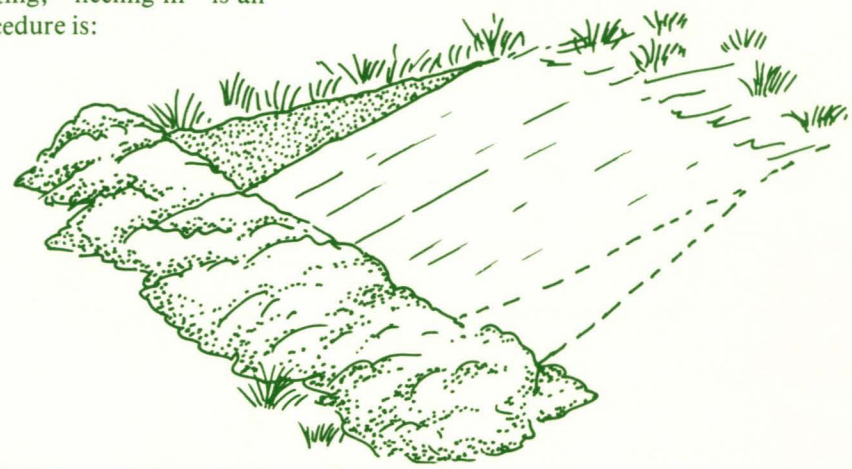
Freezing also causes mortality. Some seedlings will also die if you separate them while they are frozen. Immerse frozen bales in cool water before separating seedlings. If possible, plant seedlings immediately after you receive them from the nursery. If storage is necessary, use spacers between packages to allow air to circulate and prevent over heating. Plant sand pine seedlings within a week from the time they arrive from the nursery.

Cold Storage

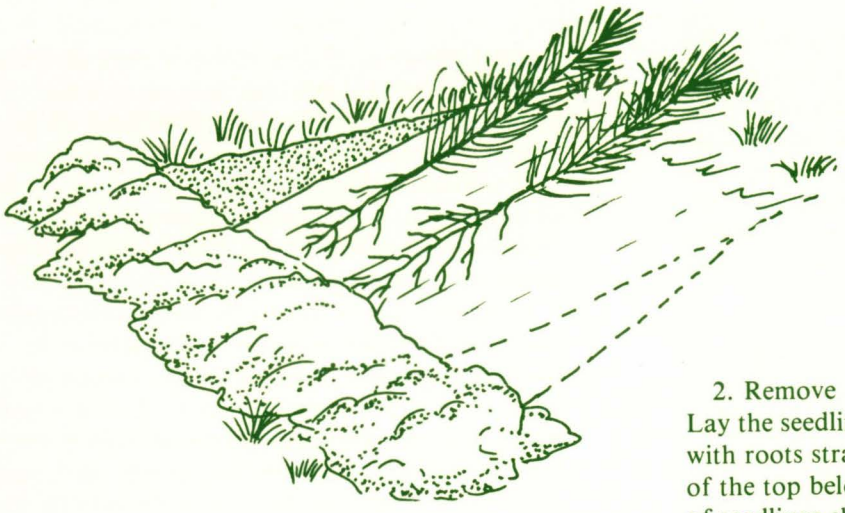
You can hold dormant seedlings in cold storage at temperatures from 32° to 40° F (0° to 4° C) for a maximum of 10 weeks if you pack them in standard Forest Service type bales, and for 12 weeks if in kraft polyethylene (K-P) bags. Plant nondormant stock first. Seedlings stored in a warehouse or on shaded racks need special attention. Seedlings packed in standard Forest Service type bales with wet media and watered upon receipt and biweekly thereafter, can be stored for up to 8 weeks. Protect them from heat and sub-freezing temperatures. Do not water them if they are packed with a clay slurry dip. Seedlings packed in kraft polyethylene bags can be stored in a cool, moist place for up to 8 weeks, provided they are encased in wet packing or a clay slurry dip. Otherwise, 4 weeks is the maximum storage time. Do not water seedlings packed in K-P bags.

"Heeling In"

If seedlings must be kept for an additional period of time before planting, "heeling in" is an accepted practice. The procedure is:

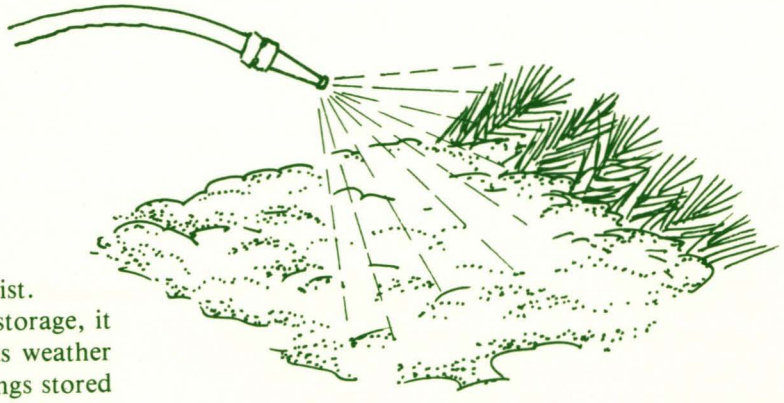


1. Prepare a V-shaped ditch in soil cleared of vegetation 2 to 4 inches (5 to 10 cm) deeper than the tree roots are long. Smooth one side of the trench. Sandy or loamy soil is best for ease of covering the seedlings and watering them. If available, use an area with some shelter from the sun and wind and near a source of water.



2. Remove the seedlings from their package. Lay the seedlings on the smooth side of the trench with roots straight and 1 to 2 inches (2.5 to 5 cm) of the top below the surface of the soil. The layer of seedlings should be no more than 2 to 3 inches (5 to 7.6 cm) thick. It may be necessary to break large bundles.

3. Refill the trench with loose soil, pack firmly, and water. Be sure all of the roots are covered.



4. Water as needed to keep the soil moist.

Remember, whatever the method of storage, it is best to plant the seedlings as soon as weather and soil conditions permit. Plant seedlings stored the longest first. Do not expose seedling roots to air any longer than necessary.

PLANTING THE SEEDLINGS

Time to Plant.—For conventional bare root seedlings, the most favorable time to plant is during the dormant season. (The season can be extended from 2 to 4 weeks if dormant seedlings are held in cold storage). Avoid planting if the ground is hard — either frozen or dry — or excessively wet or sticky. Planting when the soil is in poor condition results in low survival, poor planting production, misplanted seedlings, and poor growth.

What Spacing to Use.—Before ordering seedlings, decide on what spacing to use. No universal spacing can be recommended, but Christmas trees are most commonly planted at 5 x 5, 6 x 6, and 7 x 7 foot intervals. Many growers who use mechanical equipment for weed control use spacings such as 5 x 7 or 5 x 8 feet to allow access for tractors. Seedlings planted too close limit the use of equipment and crowd each other, resulting in the shading out of the lower branches. While tighter spacing provides more trees per acre, 5 x 5 foot and closer spacing will require harvesting at a smaller size. You must also consider the maximum use of land available, size tree desired, size of equipment if used, and growing habits of the species used when choosing the spacing for planting. The number of trees per acre by spacing is:

Spacing in feet	Trees per acre
5 x 5	1,742
5 x 7	1,245
6 x 6	1,210
6 x 7	1,037
7 x 7	889

Pines require more space than firs as they are wider at the base.

Planting Methods

There are two options—to plant by hand or with machines. Machine planting is the more economical on large areas because the same crew can plant four to five time more trees per day. Hand planting is more efficient on small areas or where the terrain is very rough. Some growers prefer hand planting because they can control spacing better and more easily align trees in both directions.

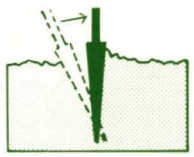
Hand Planting.—Three tools are essential to the hand planter: (1) A dibble or planting bar, (2) planting bag for carrying seedlings, and (3) wire cutters, if seedlings are packaged with steel straps.

The dibble or planting bar blade must be 10 inches (25 cm) long, or plantings will be too shallow. On rocky or heavy soils, the KBC planting bar or equivalent is recommended.

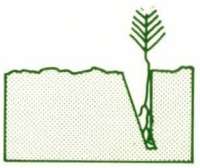
A planting bag is more efficient than a tray or bucket and is easier on workers. The planter bends over only once to plant each tree, compared to three times when using a tray or bucket. As a result, a worker can plant 25 percent more seedlings in a day. A suitable bag holds about 250 seedlings and has an adjustable shoulder strap, plus a strap which secures the bag to the planter's waist.

If a hired crew plants your trees, a good foreman is essential. The foreman should spot check each planter's work several times each day and check spacing constantly.

Here is a good hand planting procedure:



1. Insert dibble at angle shown and push forward to upright position (don't compact the soil by rocking the dibble back and forth).



2. Remove the dibble and insert a seedling deep in the hole, withdrawing seedling until root collar is at or slightly below ground level and roots are straight.

3. Insert dibble part way, push and twist forward closing top of planting slit.

4. Push dibble straight down to depth of blade.

5. Rock dibble back and forth to pack soil firmly against root.

6. Fill in last hole by stamping with heel.

The most common mistakes in hand planting are:

1. Failure to open a hole the full length of the planting bar, resulting in U-roots.
2. Failure to push the seedling to the bottom of the hole and then to pull it up to the proper position—again resulting in U-roots.
3. Failure to close the hole tightly.
4. Tree planter trims the roots with a thumb or a knife. This results in short or stripped roots. If root pruning is needed, the foreman or strawboss should do it.
5. Poor spacing.
6. No wet moss or other material in planting bags.
7. Carrying trees in hand while planting.
8. Not closing bale or bag after replenishing planting bag.
9. Discarding seedlings. This is all too common among slow planters who wish to conceal their lack of production. A good worker on easy sites can plant from 800 to 1,000 seedlings per day.

Machine Planting.—No one planting machine is acceptable throughout the South because conditions vary. Fortunately, however, you have a wide choice of good machines and should have little difficulty in finding one particularly suited to your area.

Protecting seedlings during machine planting is just as important as in hand planting. Keep the seedlings covered and keep the roots moist.

As in hand planting, frequent checks will be necessary to assure that seedlings are being planted properly. Key points include: (1) Proper depth of the trench, (2) correct tracking of the packing wheels, and (3) proper closure of the trench by the packing wheels. Check root placement by opening one side of the trench with a shovel to expose the seedling in place. For examples of faults and their correction, see the trouble-shooting guide.

Trouble Shooter's Guide for Machine Planting

Symptom	*Possible Causes*
L- or U-Root	Insufficient weight or hydraulic pressure on frame or planting box
	Need hydraulic fluid
	Worn coulter (riding on hub)
	Gap between coulter and shoe is too great (buildup of debris)
	Worn planting shoe or foot
	Soil too dry
	Planting seedling too deep in trench
Seedlings damaged by packing wheels	Packing wheel misaligned
	Packing wheels too close
Seedlings thrown out of ground or planted at angle	Angle of packing wheels too flat
	Releasing seedling too late
	Mud buildup on packing wheels

PLANTATION MANAGEMENT

The appropriate cultural treatments following planting are essential for a successful Christmas tree operation. Many past failures have been the result of neglecting competition control, fertilization, shaping the trees and protection from animals, fire, insects and disease.

COMPETITION CONTROL

Grasses, weeds and woody vegetation compete with the tree seedling for light, water and nutrients. For optimum growth and highest quality the control of competing vegetation should begin the first year. The simplest method is to mow as frequently as needed. This could be as often as once a month. Usually a combination of mechanical (mowing or cultivating) and chemical treatments are the most effective. The best treatments will depend on the competing vegatation.

This landowner uses herbicides to control vegetation.

Brush or woody plants are best controlled by a foliar herbicide spray in the late spring or early summer after the leaves have gained their full size, but before they develop a hard, waxy coat. Take care to control drift and to minimize contact with the Christmas tree stock. If oil is used as a sticker, caution becomes critical as the oil may burn the tree foliage and cause distorted growth. Use a herbicide registered for that use by appropriate State and Federal agencies. Check the manufacturers' labels for registered uses and precautions. Contact the extension service or your State forestry agency for details. Mixing instructions will appear on the labels of registered herbicides and should be followed closely for best results and safe application.

Correct chemical treatment of grasses and weeds is also important. Guidance can be found in state publications and from local, State, and Federal agencies. Failure to control competing vegetation can result in early mortality from competition for light, water, and nutrients. Other serious impacts can result in loss of lower limbs, misshapen trunk, and multiple stems from shading and physical distortion.

Take care in mowing, cultivating and spraying to avoid breaking branches and wounding the trunk. In general, the use of herbicides close to the tree combined with mowing or cultivation of the remaining areas is the most economical treatment. Cultivation is seldom used after planting and is not recommended for longer than 1 to 2 years, as root damage may occur. On slopes, cultivation can result in loss of topsoil through erosion.

FERTILIZATION

Fertilization is usually not needed, but may be required on poorer sites and with more demanding species. Check your soil fertility by collecting soil samples for analysis. Your county extension agent can provide the instructions and assist in obtaining the analysis and making recommendations.

Unneeded fertilizer can stimulate grass and weed growth which increases costs for competition control. Also, excess fertilizer may result in excessive height growth which adds to shearing requirements. Fertilization may improve the color of some species, but this use should be undertaken cautiously and far enough in advance to avoid flushes of growth in the fall.

SHAPING THE TREE

Shaping is essential to produce quality trees. The objectives are: to control height; to develop one central leader; to develop symmetrical form; to develop compact foliage; to eliminate deformities; and remove lower limbs to form a handle. As in other treatments, shearing requirements will vary by species, site fertility, climate and market preference. Some species, such as eastern redcedar, needs less shearing to develop a good form. Normally, shaping by shearing is not needed until the trees reach 2 or more feet (60 cm) in height. Faster growing trees, such as Virginia pine, may require annual shearing from the second or third year while slower starting trees, such as white pine, may not need shearing until the fourth growing season. Cut off the lower limbs to develop a handle 8 to 10 inches (20 to 25 cm) long and to promote a good lower whorl of branches.

The time to shear is when the new growth is fully developed, but before it hardens. Make your cuts in the new growth. When the cut is made in old growth, new buds do not form and a dead limb stub results. Check with recommendations for shearing dates for species in a given locality. Terminal buds should be cut at a 45 degree angle. Cut the next lateral branches from 3 to 6 inches (7.6 to 15 cm) shorter to prevent extra terminals from developing. Shearing, once started, should be an annual practice. If a year is skipped, a bare area often results—which will lower the tree quality.

Failure to shear one year usually results in an unmerchantable or poor quality tree.

Shearing is an operation requiring constant attention to see that safety equipment and safe practices are followed. When using knives, shearer should wear a shinguard on the same leg as the knife hand. **Always** use a stick rather than a hand to hold or lift foliage while shearing.

Proper pruning procedures are necessary to produce a well formed tree.

PROTECTING THE PLANTATION

Among the threats to a successful Christmas tree operation are insect attacks, damage by diseases, destruction by fire, animal damage and theft. Your investment in time and money warrants vigilance to avoid unnecessary losses from any of these problems. Check the plantation frequently, so early corrective action can be taken.

Insect attack.—A number of insects attack and damage Christmas trees. These pests will vary by location and tree species. The most common insects and tree hosts are:

Aphids

.....Balsam wooly aphid: Attacks trunks and twigs of Fraser fir

.....White pine aphid: Attacks trunks and twigs of white pine

.....Pine leaf: Attacks the needles of white pine and spruce

Bagworms

.....Bagworms eat the needles of Eastern redcedar and spruce.

Balsam gall midge
.....This pest eats the needles of Fraser fir.

Mites
.....The needles of Fraser fir and spruce are susceptible to mites.

Pales weevil
.....Stems of pine seedlings are attacked (only a problem on recently cut over sites).

Pine tip moth
.....Buds and twigs of pines are attacked.

Pine webworm
.....Needles and twigs of pines are attacked.

Red-headed pine sawfly
.....This sawfly eats the needles of pines.

Scale insects
.....These pests are found on the needles of pines.

White pine weevil
.....This beetle attacks white pine and scotch pine.

Most of these insect pests will not kill the tree but can degrade or deform it if not treated. Insecticides are most commonly applied with tractor mounted power sprayers, back pack sprayers or back pack mist blowers. Consult your extension service or State service forester for the latest information on control measures.

Diseases.—The most common diseases affecting Christmas tree plantations are:

Brown spot needle disease
.....Attacks needles of pines.

Cedar blight
.....Attacks branches and twigs of Arizona cypress and redcedar.

Cercaspora blight
.....Attacks Arizona cypress and redcedar.

Fusarium rusts and pitch cankers — pines — stems and branches
.....Attacks stems and branches of pines.

Needle cast
.....Affects pines.

Needle rusts
.....Affects pines.

Most of the diseases that attack Christmas trees may degrade the tree. Cedar and Cercospora blights can be controlled by some fungicides but badly infected trees should be removed and burned. Brownspot, needle casts and needle rusts also respond to some fungicides. Fusarium rusts and pitch cankers are best treated by removing infected branches. Avoid using suspectible species in areas of high incidence of specific diseases. Consult your local extension service or State service forester for the latest information on control measures. Chemicals used for insect and disease control are constantly being reviewed for safety and effectiveness and new formulations registered for use. For these reasons specific pesticides are not mentioned. Carefully read and follow instructions on labels of all pesticide containers for safe and effective use.

Animal damage.—Livestock and Christmas trees don't mix, so exclude cattle from the plantation. Deer, rabbits and mice may present problems in some areas. Repellants may be necessary for protection from deer in an area with a high population. Rabbits and mice can usually be discouraged by grass and weed control.

Fire.—Exercise care to exclude fire from a Christmas tree plantation. A fire can cause total loss to trees in its path. Maintaining a fire break around the plantation may be wise insurance.

Theft.—As the trees reach merchantable size some precautions may be necessary to prevent theft. November and December is the danger period. Those plantations readily accessible or visible to the public are most vulnerable.

HARVESTING

Cut the trees with a sharp saw at right angles to the stem. Use either a hand saw or a power saw. Knowledge of the grades and specifications will help avoid either degrading or shortening the tree because of too short a handle or later trimming if the cut is at an angle or the handle is too short.

Trees should be carried, not dragged, to prevent unnecessary damage to foliage and branches. If you are shipping the trees, some form of bundling or tying will lower handling and shipping costs as well as reduce damage in transit. Several bundling machines are available. Manually tying individual trees is very time consuming.

After cutting, store the trees in shaded and sheltered places to prevent sun and wind from drying out the foliage while awaiting shipping. Separating by grades and species in the storage area will prevent unnecessary handling later.

MARKETING

SALE TO WHOLESALER

The main advantages of selling trees to a wholesaler is: (1) you save time, (2) you sell large quantities of trees at one time, (3) no trees are left over, and (4) the wholesaler assumes the market risks and transportation costs. The main disadvantage is a lower return on investment. Selling trees to a wholesaler is the least profitable method for the Christmas tree producers and for this reason, the grower should consider the other two methods of marketing where possible. This is especially true where small acreages are concerned and the grower does not have the advantage of large volumes to offset the lower price received per tree.

SALE TO RETAILERS

Retailing trees requires more of your time for harvesting and marketing, but you receive a higher price per tree. This method of marketing requires that the grower contact outlets that retail trees such as supermarkets, service clubs and nurseries. Prices and delivery dates should be negotiated well in advance with the retailers because of the competition from northern-grown trees where orders are sometimes placed a year in advance by the retailers.

DIRECT TO CONSUMER

Direct selling to the consumer can be accomplished by marketing the trees on a retail lot or by a choose-and-cut operation where the trees are sold in the field where they are grown. Selling direct to the consumer usually involves more time and higher risks but generally results in a higher profit than selling to wholesalers or retailers. When selling trees on a retail lot there are certain requirements and factors which should be present to insure a successful operation. Some of these important considerations are:

..... number of potential customers. Demand in small towns may not be adequate.

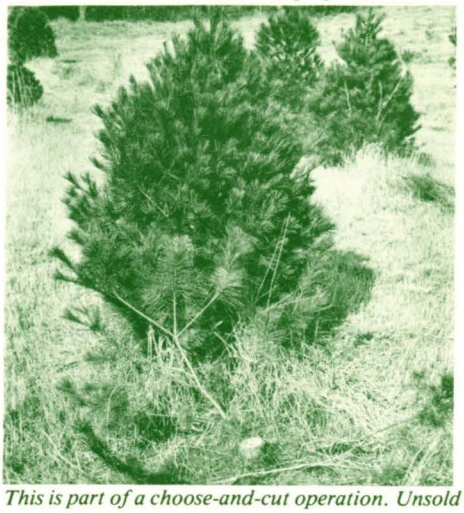
..... retail lot should be located where traffic potential insures adequate exposure of trees to public.

..... parking and lighting facilities must be adequate to meet needs of growers and customers.

..... a business license and liability insurance is required.

..... growers may sell more trees on a well located retail lot than in the field, but expenses are higher because of harvesting and transportation costs and costs associated with renting the lot.

Selling trees in the field by the choose-and-cut method is especially suited to small Christmas tree producers, particularly if their trees are grown in an area convenient to a population center.



This is part of a choose-and-cut operation. Unsold trees may be marketed the following year to wholesalers, retailers or choose and cut customers.

Some of the benefits of this form of marketing are:

..... highest profit potential per tree

..... no transportation cost

..... no business license required

..... lower harvesting cost because buyers usually cut their own trees. The grower usually provides the necessary tools.

..... the Christmas tree producer is in a more flexible position. Trees not cut in any one year are left free to grow into larger trees and not wasted such as unsold trees on a retail lot.

..... because some trees in a rotation are merchantable before others, the grower can receive an earlier return by selling these trees early in the rotation. This advantage is usually not available in other forms of marketing due to high costs per tree because of low volume per acre.

..... growers must provide all-weather access and a method of marking the price of their trees.

The choose-and-cut marketing method fits into the family tradition in this country where the purchase of a Christmas tree provides a family outing and enhances the spirit of Christmas for many people.

INVESTMENT ANALYSIS

Economic conclusions in this publication are based on a relatively small operation. Large capitol expenditure for equipment required for 50 to 200 acre (20 to 80.9 ha) operations are not considered. Theoretically it would not be economically feasible to purchase expensive, heavy duty equipment for operations slightly larger in scope than previously discussed. The Christmas tree grower should decide on a small scale operation with relatively low costs, or jump into a large operation of 50 acres (20 ha) or more and invest in expensive equipment. A larger volume of production is necessary to justify a large capitol investment. An exception would be where this equipment is already available for other farm operations.

The following investment analysis was developed by using the PAR-3 computer program. This program is a modification of the Investment Analysis Program developed by Clark Row, as described in publication SO-6, *Determining Forest Investment Rates-of-Return by Electronic Computer, 1962, USDA Forest Service.*

PAR-3 develops present net worth and annual equivalent income for six interest rates simultaneously for six alternatives. The program also calculates the internal rate of return for each alternative.

INVESTMENT TERMS

To help readers of this publication visualize the value and difference between these expressions of return on investment, a brief description of each follows:

Present Net Worth (PNW) is the difference between the present value of all cost (present and future) and income at a given interest rate. A positive PNW indicates that the investment furnishes a higher return than the selected interest rate. A PNW of zero indicates an investment that is just equaling the selected rate. The selected interest rate usually indicates the investors minimum objective or alternative investment opportunity.

Annual Equivalent Value is the amount of annual income or payment that will just equal the present net worth of an investment during its lifetime. In forestry these values are theoretical since income does not occur on an annual basis. However these figures are useful in comparing forestry with investments that have annual returns.

Rate of Return (sometimes referred to as Internal Rate of Return) is the compound interest rate used where the present net worth is zero. In other words rate of return is the compound interest rate that equates the present value of all future incomes with the present value of all future cost. It is assumed that all incomes can be reinvested at the same rate of return.

Costs.—Because total costs of a Christmas tree operation will vary by tree species, regions, and other factors, three (3) cost regimes were used in our calculations: low, medium, and high costs. Annual or periodic practices will also vary with local conditions and species planted. **Therefore the total costs of each cost regime should be considered instead of relying too heavily on each individual item within a cost regime.** Total costs in the three cost regimes have a wide enough spread to allow for interpolation. The following charts (tables 1, 2 and 3) show a breakdown of costs used in this investment analysis. All costs are on a per acre basis.

Table 1.—Low cost regime schedule

Year	Treatment	Rotation age				
		5	6	7	8	9
		Costs				
0	Site Preparation	$ 25	25	25	25	25
0	Planting (include seedlings)	50	50	50	50	50
1	Weed Control	25	25	25	25	25
2	Weed Control	25	25	25	25	25
3	Weed Control	25	25	25	25	25
3	Basal prune	20	20	20	20	20
3	Shearing	20	20	20	20	20
4	Weed control	25	25	25	25	25
4	Shearing	25	25	25	25	25
4	Harvest 400 trees	120				
5	Weed control	25	25	25	25	25
5	Shearing	15	25	25	25	25
5	Harvest 600 trees	180				
5	Harvest 400 trees		120			
6	Weed control		25	25	25	25
6	Shearing		20	30	30	30
6	Harvest 600 trees		180			
6	Harvest 400 trees			120		
7	Weed control			25	25	25
7	Shearing			20	30	30
7	Harvest 600 trees			180		
7	Harvest 400 trees				120	
8	Weed control				25	25
8	Shearing				25	35
8	Harvest 600 trees				180	
9	Weed control					25
9	Shearing					25
9	Harvest 600 trees					210

Table 2.—Medium cost regime schedule

Year	Treatment	Rotation age				
		5	6	7	8	9
		Costs				
0	Site preparation	$ 75	75	75	75	75
0	Planting (including seedling)	85	85	85	85	85
1	Weed control	35	35	35	35	35
2	Weed control	35	35	35	35	35
3	Weed control	35	35	35	35	35
3	Basal prune	25	25	25	25	25
3	Shearing	30	30	30	30	30
4	Weed control	35	35	35	35	35
4	Shearing	35	35	35	35	35
4	Harvest 400 trees	120				
5	Weed control	35	35	35	35	35
5	Shearing	30	50	50	50	50
5	Harvest 600 trees	180				
5	Harvest 400 trees		120			
6	Weed control		35	35	35	35
6	Shearing		30	55	55	55
6	Harvest 600 trees		180			
6	Harvest 400 trees			120		
7	Weed control			35	35	35
7	Shearing			30	55	55
7	Harvest 600 trees			180		
7	Harvest 400 trees				120	
8	Weed control				35	35
8	Shearing				35	60
8	Harvest 600 trees				180	
8	Harvest 400 trees					120
9	Weed control					35
9	Shearing 600 trees					35
9	Harvest 600 trees					210

Table 3.—High cost regime schedule

Year	Treatment	Rotation age				
		5	6	7	8	9
		Costs				
0	Site preparation	$125	125	125	125	125
0	Planting (including seedlings)	120	120	120	120	120
1	Weed control	45	45	45	45	45
2	Weed control	45	45	45	45	45
3	Weed control	45	45	45	45	45
3	Basal prune	30	30	30	30	30
3	Shearing	40	40	40	40	40
4	Weed control	45	45	45	45	45
4	Shearing	45	45	45	45	45
4	Harvest 400 trees	120				
5	Weed control	45	45	45	45	45
5	Shearing	45	75	75	75	75
5	Harvest 600 trees	180				
5	Harvest 400 trees		120			
6	Weed control		45	45	45	45
6	Shearing		50	80	80	80
6	Harvest 600 trees		180			
6	Harvest 400 trees			120		
7	Weed control			45	45	45
7	Shearing			50	80	80
7	Harvest 600 trees			180		
7	Harvest 400 trees				120	
8	Weed control				45	45
8	Shearing				55	85
8	Harvest 600 trees				180	
8	Harvest 400 trees					120
9	Weed control					45
9	Shearing					55
9	Harvest 600 trees					210

Costs such as chemical treatments for insects and diseases and tree coloring prior to final harvest are not specifically identified in tables 2 and 3. However, the grower can add these costs to the total and still determine the appropriate cost level. The high-cost table will cover most situations except those growers that have to pay a very high price for seedlings, such as Frazer fir. The low cost option would likely fit the grower who plants trees on pasture land or on land that has been cultivated for other row crops in recent years. Most growers will likely fall into the medium cost level on a 5-year rotation.

Other Economic Assumptions

Most of the tables in appendix I are based on harvesting 1,000 trees per acre out of 1,200 planted. Tables 4, 14 and 15 are based on the assumption that only 800 trees will be harvested. Table 16 is based on an annual cost of $20 per acre per year. All the other tables are based on an annual cost of $4 per acre per year. For the purpose of this analysis, the annual cost is considered to be the ad valorem property tax paid by the owner.

Five rotation ages are evaluated ranging from 5 to 9 years. In each rotation we calculated a harvest of 400 trees a year preceeding the final harvest and a final harvest of 600 trees. An exception is made in tables 4, 14 and 15, where we assumed a total of only 800 trees would be harvested and only 400 trees in the final harvest.

All the tables are valid regardless of the species planted because the rate of return reflects various costs, rotation lengths and returns per tree that will cover situations encountered with any species. All tables showing return on investment are in appendix I except table 4, which follows immediately and serves as an example.

INCOME TAX CONSIDERATION

Income from cut Christmas trees qualifies for capital gains tax treatment if the tree is 6 years old from seed at the time of harvest, and if other requirements are met. In other words, trees cut 4 years after the plantation is established would qualify for capital gains if 2-year-old seedlings were planted. In the unlikely event that you decide to sell the trees on a lump sum basis, then check with a tax expert to insure that you qualify for capital gains tax treatment. Trees that you cut and consider as a part of your trade or business[1], such as a choose-and-cut operation, or trees sold on a per tree basis with economic interest retained in all standing trees[2] will present no difficulty in receiving capital gains tax treatment. Income from Christmas trees sold with roots intact does not qualify for capital gains tax benefits. Keep accurate records on all costs and income associated with your Christmas tree business.

SENSITIVITY ANALYSIS

As shown in the charts in the appendix, variances in periodic costs are the most sensitive factor. Reduction in trees harvested per acre is the next most sensitive factor; differences in annual costs (ad valorem taxes) have little effect on investment returns. Unless you receive a substantial increase in the price per tree, each year's increase in rotation length causes a substantial drop in your rate of return, but a relative small decrease in present net worth. This analysis indicates that the return on your investment is excellent on all situations covered in this analysis. In almost all options covered, your present net worth would more than cover the cost of purchasing land for growing

[1]Based on Internal Revenue Service Code (IRS), 631(a).
[2]IRS Code, 631(b).

Table 4.—Present net worth at 6 percent interest[1]

Price/tree	Rotation age				
	5	6	7	8	9
	Dollars per acre				
$ 2.00	$ 691	$ 586	$ 485	$ 384	$ 269
2.50	1,027	910	794	681	554
3.00	1,362	1,232	1,104	978	840
3.50	1,698	1,554	1,414	1,275	1,125
4.00	2,033	1,877	1,723	1,572	1,410
4.50	2,368	2,199	2,033	1,870	1,695
5.00	2,704	2,521	2,342	2,167	1,981
5.50	3,040	2,844	2,652	2,464	2,266
6.00	3,375	3,166	2,961	2,761	2,551
6.50	3,711	3,488	3,271	3,058	2,836
7.00	4.046	3,811	3,580	3,356	3,122
7.50	4,382	4,133	3,890	3,653	3,407
8.00	4,717	4,455	4,199	3,950	3,692
9.00	5,388	5,100	4,819	4,544	4,263
10.00	6,059	5,744	5,438	5,139	4,833
11.00	6,730	6,389	6,057	5,733	5,404
12.00	7,401	7,034	6,676	6,328	5,974

[1]Assumptions: Medium cost operation (table 2), annual cost of $4 per acre; 800 trees harvested per acre.

Christmas trees. The lowest present net worth is $295 per acre on the high cost—a 9-year rotation.

LAND COST

Cost of land is not considered in this analysis because land is a separate investment and will likely appreciate in value on its own. In any event, if your initial land cost is considered, then an end value should be placed on it. This means that only the cost of holding land would be considered, and only then in the event that the land would not appreciate in value equal to an alternate investment opportunity. However, if you purchase land for a Christmas tree operation and plan to hold the land indefinitely, you can reduce your present net worth per acre by the cost of the land per acre. Keep in mind that, in this case, the Christmas tree operation has paid for the purchase price of the land.

RISK FACTORS

Establish and maintain fire lanes around the plantation to reduce the fire risk. Use proper chemical treatments to reduce or eliminate insect and disease risks. One of the greatest risks is theft (in December, especially) on Christmas tree plantations that are easily accessible or visible to the public.

These risks, and the intensive labor involved in the operation, justify a higher rate of return than you could receive by purchasing bonds, for example. Fortunately, the extremely high rate of return received from a well managed operation compensates the grower generously for these risk factors.

INVESTMENT ANALYSIS CONCLUSIONS

Results of the investment analysis indicate that a well managed Christmas tree operation gives an excellent return on investment. Even the high cost situation gives a higher return on investment than can be received from most other agricultural operations. Again, it should be emphasized that these returns are available only to those willing to manage the operation properly and perform the necessary cultural operations at the right time, in the proper manner.

The proceeding pages discussed briefly the cultural operations involved in growing Christmas trees. Because of the wide range of climatic and physiographic regions, species adaptability, marketing opportunities, and other variables the section on cultural operations must be considered in relation to this financial analysis, to achieve a successful Christmas tree operation. For more detailed instructions in your local areas send for information contained in the comprehensive bibliography on pages 23, 24 and 25.

Table 5.—Rate of return: low cost[1]

Price/tree	Rotation age				
	5	6	7	8	9
	Percent				
$ 2.00	85	61	47	37	30
2.50	98	71	54	43	35
3.00	*	79	61	48	40
3.50	*	85	66	53	43
4.00	*	91	70	57	47
4.50	*	97	74	60	49
5.00	*	*	78	63	52
5.50	*	*	81	65	54
6.00	*	*	84	68	56
6.50	*	*	87	70	58
7.00	*	*	90	72	60
7.50	*	*	92	74	61
8.00	*	*	94	76	63
9.00	*	*	99	79	66
10.00	*	*	100 +	82	68
11.00	*	*	100 +	85	71
12.00	*	*	100 +	88	73

[1]Figures shown are rates of return in percent. Assumptions include low cost operation (see table 1); an annual cost of $4 per acre; and 1,000 trees harvested per acre.

*Exceeds 100 percent. Computer does not calculate rates of return over 100 percent.

Table 6.—Present net worth at 6 percent interest, low cost[1]

Price/tree	Rotation age				
	5	6	7	8	9
	Dollars per acre				
$ 2.00	1,179	1,084	992	902	797
2.50	1,596	1,485	1,378	1,272	1,152
3.00	2,014	1,886	1,763	1,642	1,507
3.50	2,432	2,288	2,149	2,012	1,862
4.00	2,850	2,689	2,534	2,382	2,217
4.50	3,267	3,090	2,919	2,751	2,572
5.00	3,685	3,491	3,305	3,121	2,927
5.50	4,103	3,893	3,690	3,491	3,282
6.00	4,520	4,294	4,075	3,861	3,637
6.50	4,938	4,695	4,461	4,231	3,992
7.00	5,356	5,096	4,846	4,601	4,348
7.50	5,773	5,498	5,231	4,971	4,703
8.00	6,191	5,899	5,617	5,341	5,058
9.00	7,026	6,701	6,388	6,081	5,768
10.00	7,862	7,504	7,158	6,821	6,478
11.00	8,697	8,307	7,929	7,561	7,188
12.00	9,532	9,109	8,700	8,301	7,898

[1]Assumptions: Low cost operation (table 1); annual cost of $4 per acre; 1,000 trees harvested per acre.

Table 7.—Annual equivalent income at 6 percent interest, low cost[1]

Price/tree	Rotation age				
	5	6	7	8	9
	Dollars per acre per year				
$ 2.00	173	159	146	133	117
2.50	235	218	203	187	169
3.00	296	277	259	241	222
3.50	357	336	316	296	274
4.00	419	395	373	350	326
4.50	480	454	429	405	378
5.00	542	513	486	459	430
5.50	603	572	543	513	483
6.00	665	631	599	568	535
6.50	726	690	656	622	587
7.00	787	749	712	677	639
7.50	848	808	769	731	691
8.00	910	867	826	785	744
9.00	1,033	985	939	894	848
10.00	1,156	1,103	1,052	1,003	952
11.00	1,288	1,221	1,166	1,112	1,057
12.00	1,402	1,339	1,279	1,220	1,161

[1]Assumptions: Low cost of operation (see table 1); an annual cost of $4 per acre, and a harvest of 1,000 trees per acre.

Table 8.—Rate of return: medium cost[1]

Price/tree	Rotation age				
	5	6	7	8	9
			Percent		
$ 2.00	47	33	24	18	14
2.50	59	42	32	25	19
3.00	68	50	38	30	24
3.50	76	56	43	34	28
4.00	83	61	47	38	31
4.50	90	66	51	41	33
5.00	96	70	54	43	36
5.50	*	74	57	46	38
6.00	*	77	60	48	40
6.50	*	80	62	50	42
7.00	*	83	65	52	43
7.50	*	86	67	54	45
8.00	*	89	69	56	46
9.00	*	94	73	59	49
10.00	*	98	76	62	51
11.00	*	*	79	64	53
12.00	*	*	82	66	55

[1]Figures shown are rates of return; assumptions include medium cost of operation (table 2), an annual cost of $4 per acre and an annual harvest of 1,000 trees.

*Exceeds 100 percent. Computer does not calculate rates of return over 100 percent.

Table 9.—Present net worth at 6 percent interest, medium cost[1]

Price/tree	Rotation age				
	5	6	7	8	9
			Dollars per acre		
$ 2.00	1,020	903	788	674	549
2.50	1,438	1,305	1,174	1,045	904
3.00	1,855	1,706	1,559	1,415	1,259
3.50	2,273	2,107	1,944	1,784	1,614
4.00	2,691	2,508	2,330	2,155	1,969
4.50	3,108	2,910	2,715	2,525	2,324
5.00	3,526	3,311	3,100	2,895	2,679
5.50	3,944	3,712	3,486	3,265	3,034
6.00	4,361	4,113	3,871	3,635	3,389
6.50	4,779	4,515	4,256	4,005	3,744
7.00	5,197	4,916	4,642	4,374	4,099
7.50	5,615	5,317	5,027	4,745	4,455
8.00	6,032	5,719	5,413	5,114	4,810
9.00	6,868	6,521	6,183	5,854	5,520
10.00	7,703	7,324	6,954	6,594	6,230
11.00	8,538	8,126	7,725	7,334	6,940
12.00	9,374	8,929	8,495	8,074	7,650

[1]Assumptions: Medium costs (table 2); annual cost of $4 per acre; 1,000 trees harvested per acre.

Table 10.—Annual equivalent income at 6 percent interest, high cost[1]

Price/tree	Rotation age				
	5	6	7	8	9
	Dollars per acre				
$ 2.00	102	86	71	56	40
2.50	151	134	117	100	82
3.00	200	181	162	144	123
3.50	250	229	208	187	165
4.00	299	276	253	231	207
4.50	348	323	299	275	249
5.00	398	371	344	319	291
5.50	447	418	390	362	333
6.00	496	465	435	406	375
6.50	546	513	481	450	417
7.00	595	560	526	493	459
7.50	644	608	572	537	501
8.00	694	655	617	581	543
9.00	792	750	708	668	627
10.00	891	845	799	756	711
11.00	989	939	890	843	794
12.00	1,088	1,034	981	930	878

[1]Assumptions: Medium costs (table 2); annual cost of $4 per acre; 1,000 trees harvested per acre.

Table 11.—Rate of return: high cost[1]

Price/tree	Rotation age				
	5	6	7	8	9
	Percent				
$ 2.00	42	29	22	16	12
2.50	52	38	29	22	17
3.00	60	44	34	27	22
3.50	68	50	39	31	25
4.00	74	55	43	34	28
4.50	80	59	46	37	31
5.00	85	63	49	40	33
5.50	90	67	52	42	35
6.00	94	70	55	44	37
6.50	99	73	57	46	39
7.00	*	76	59	48	40
7.50	*	78	61	50	42
8.00	*	81	63	51	43
9.00	*	85	67	54	45
10.00	*	89	70	51	48
11.00	*	93	73	59	50
12.00	*	97	76	62	52

[1]Assumptions: High costs (table 3); annual cost of $4 per acre; 1,000 trees harvested per acre.
*Exceeds 100 percent. Computer does not calculate rates of return over 100 percent.

Table 12.—Present net worth at 6 percent interest, high cost[1]

Price/tree	Rotation age				
	5	6	7	8	9
	Dollars per acre				
$ 2.00	861	716	577	442	295
2.50	1,279	1,117	963	812	650
3.00	1,696	1,518	1,348	1,182	1,005
3.50	2,114	1,920	1,733	1,552	1,360
4.00	2,532	2,321	2,119	1,922	1,715
4.50	2,950	2,722	2,504	2,292	2,070
5.00	3,367	3,124	2,889	2,662	2,425
5.50	3,785	3,525	3,275	3,032	2,780
6.00	4,203	3,926	3,660	3,401	3,135
6.50	4,620	4,327	4,046	3,771	3,490
7.00	5,038	4,729	4,431	4,141	3,846
7.50	5,456	5,130	4,816	4,511	4,201
8.00	5,873	5,531	5,202	4,881	4,556
9.00	6,709	6,334	5,972	5,621	5,266
10.00	7,544	7,136	6,743	6,361	5,976
11.00	8,379	7,939	7,514	7,101	6,686
12.00	9,215	8,741	8,284	7,841	7,396

[1]Assumptions: High costs (table 3); annual costs of $4 per acre; 1,000 trees harvested per acre.

Table 13.—Annual equivalent income at 6 percent interest, medium cost[1]

Price/tree	Rotation age				
	5	6	7	8	9
	Dollars per acre per year				
$ 2.00	127	105	85	65	43
2.50	188	164	142	119	96
3.00	249	223	198	174	148
3.50	310	282	255	228	200
4.00	372	341	312	283	252
4.50	433	400	368	337	304
5.00	495	459	425	391	357
5.50	556	518	481	446	409
6.00	618	577	538	500	461
6.50	679	636	595	554	513
7.00	741	695	651	609	565
7.50	802	754	708	663	618
8.00	864	813	765	718	670
9.00	986	931	878	826	774
10.00	1,109	1,049	991	935	879
11.00	1,231	1,167	1,105	1,044	983
12.00	1,354	1,285	1,218	1,153	1,087

[1]Assumptions: High cost (table 3); annual cost of $4 per acre; 1,000 trees harvested per acre.

Table 14.—Rate of return: medium cost[1]

Price/tree	Rotation age				
	5	6	7	8	9
	Percent				
$ 2.00	47	33	24	18	14
2.50	59	42	32	25	19
3.00	68	50	38	30	24
3.50	76	56	43	34	28
4.00	83	61	47	38	31
4.50	90	66	51	41	33
5.00	96	70	54	43	36
5.50	*	74	57	46	38
6.00	*	77	60	48	40
6.50	*	80	62	50	42
7.00	*	83	65	52	43
7.50	*	86	67	54	45
8.00	*	89	69	56	46
9.00	*	94	73	59	49
10.00	*	98	76	62	51
11.00	*	100 +	79	64	53
12.00	*	100 +	82	66	55

[1]Assumptions: Medium cost (table 2); annual cost of $4 per acre; 800 trees harvested per acre.
*Exceeds 100 percent. Computer does not calculate rates of return over 100 percent.

Table 15.—Annual equivalent income at 6 percent interest, medium cost[1]

Price/tree	Rotation age				
	5	6	7	8	9
	Dollars per acre per year				
$ 2.00	102	86	71	56	40
2.50	151	134	117	100	82
3.00	200	181	162	144	123
3.50	250	229	208	187	165
4.00	299	276	253	231	207
4.50	348	323	299	274	249
5.00	398	371	344	319	291
5.50	447	418	390	362	333
6.00	496	465	435	406	375
6.50	545	513	481	450	417
7.00	595	560	526	493	459
7.50	644	608	572	537	501
8.00	694	655	617	581	543
9.00	792	750	708	668	627
10.00	891	845	799	756	711
11.00	989	939	890	843	794
12.00	1,088	1,034	981	930	878

[1]Assumptions: Medium costs (table 2); annual cost of $4 per acre; 800 trees harvested per acre.

Table 16.—Present net worth at 6 percent interest, medium cost[1]

Price/tree	Rotation age				
	5	6	7	8	9
	Dollars per acre				
$ 2.00	950	821	694	569	432
2.50	1,368	1,222	1,079	939	787
3.00	1,785	1,624	1,465	1,309	1,142
3.50	2,203	2,025	1,850	1,679	1,497
4.00	2,621	2,426	2,236	2,049	1,852
4.50	3,038	2,827	2,621	2,419	2,207
5.00	3,456	3,229	3,006	2,789	2,562
5.50	3,873	3,630	3,391	3,159	2,918
6.00	4,292	4,031	3,777	3,529	3,273
6.50	4,709	4,432	4,162	3,899	3,628
7.00	5,127	4,834	4,548	4,269	3,983
7.50	5,545	5,235	4,933	4,639	4,338
8.00	5,962	5,636	5,318	5,009	4,693
9.00	6,798	6,439	6,089	5,749	5,403
10.00	7,633	7,241	6,860	6,489	6,113
11.00	8,468	8,044	7,630	7,229	6,824
12.00	9,304	8,846	8,401	7,969	7,534

[1]Assumptions: Medium costs (table 2); annual costs of $20 per acre; 1,000 trees per acre harvested.

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